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SOLID FUELS FROM THE COCONUT

Julian A. Banzon
Emeritus Professor
University of the Philippines Los Baños
College, Laguna, Philippines

ABSTRACT

Coconut shell and husk contribute 5.9 percent of Philippine energy needs, which is greater than that from locally mined petroleum oil (2.9%) or local coal (4.7%). Investments on nuclear and fossil fuels are huge in comparison with that on coconut. Coco shell, husk and leaf petiole from existing 400 million palms has the potential to supply up to 20 percent of the energy needs. It is suggested that these solid fuels be used for rural electrification.

Introduction

More or less accepted but not yet adopted because of cost, is the use of coconut oil as motor fuel. Large scale utilization in this manner would relieve the pressure of competition in the international market, by providing an alternate outlet. But costs must be reduced to be competitive with petroleum fuels; this may be attained by utilization of the hitherto largely unused products from the coconut palm.

The present study indicates that coconut shell, husk and leaf petiole, which are already being used in a limited scale commercially as solid fuels, have a potential of supplying a significant percentage of Philippine energy needs, if full advantage is taken of their presence.

The shortage of energy and effect on industry. While the shortage of energy is everybody's problem, it appears particularly acute in the Philippines. Contemporary newspaper reports attest to this.

Philippine energy consumption (1985): sources of energy and percentage contribution. This is shown in the following tabulation (1):

Imported oil		50.7%	47.2 M bbl
Conventional sources	Local Petro oil	2.9%	2.7 M bbl
	Local coal	4.7	4.38 M bbl
	Hydro	10.2	9.5 M bbl
	Geothermal	9.1	8.5 M bbl
		26.9%	25.1 M bbl

Non-conventional	Bagasse	4.94%	4.6 M bbl
	c-shell/husk	5.92	5.52 M bbl
	Rice hull	1.00	0.93 M bbl
	Wood/wood waste	5.17	4.82 M bbl
	Dendro	1.17	1.09 M bbl
		18.2%	16.96 M bbl

The above table shows that coconut shell/husk contributes 5.92% of national energy needs, which is a larger contribution than locally mined petro oil or coal. With the huge investments on petroleum exploration and development and the total loss of the Bataan nuclear plant, coconut shell/husk appears to be a better business deal.

Position of coconut shell/husk in the list of nonconventional energy sources. The contribution of coconut shell/husk is larger than that of bagasse or even that of wood/waste of the lumber industry. The coconut has characteristics that make it a more dependable energy supplier than sugarcane or timber trees or even ipil-ipil (dendrothermal).

Local petroleum oil production compared to present utilization of coconut shell/husk. Philippine petroleum oil fields are reported to have the following production (1985):

NIDO	0.381 M bbl (barrels)
MATINLOC	1.378 M bbl
CADLAO	1.23 M bbl

NIDO is said to be almost dry now. Inevitably, the other fields would also reach the same fate. The coconut is a better longtime supplier of energy. The sum of production of these 3 wells is 2.99 M bbl. Present usage of coconut shell/husk is 5.9 M bbl.

Energy potential of Philippine coconut fuels. It would be highly informative to know the energy potential of Philippine coconut solid fuels. There are at present, over 400 million coconut palms. The annual harvest is 10 to 16 billion nuts inspite of typhoons, droughts, pests and neglect. Assuming a yearly crop of 12 billion nuts and 16 x 400 million pieces of leaf petiole (palapa), we can calculate the energy potential. The following information are also needed (2):

	W/pc	MJ/kg
shell	0.193 kg	23.0
husk	0.242 kg	16.7
palapa	0.50 kg	16.7

yearly leaf production averages 16 (6)

bbl oil equivalent = 8,370 MJ/bbl

KWH equivalent = 3.6 MJ/KWH

Calculations for coconut shell:

Weight = 0.193 x 12 B = 2.316 B Kg

$$MJ = 2.316\ B\ Kg \times 23\ MJ/kg = 53.27\ B\ MJ$$

$$bbl = \frac{53.27\ B\ MJ}{8.370\ MJ\ bbl} = 6.36\ M\ bbl$$

$$KWH = \frac{53.27\ B\ MJ}{3.6\ MJ/KHW} = 14.80\ B\ KWH$$

where B = billion = 10^9

M = million = 10^6

The calculations for the total Philippine coconut production are summarized in the following table:

	Kg (B)	MJ (B)	bbl (M)	KWH (B)
shell	2.316	53.27	6.36	14.80
husk	2.904	48.61	5.81	13.50
palapa	3.200	53.57	6.40	14.88
TOTAL	8.42	155.45	18.57	43.18

Calculated worth of coconut fuels. In places where they are traded for cash, palapa sells for at least ₱0.10 per piece to as high as ₱0.25. Shell and husk are approximately ₱0.05 and ₱0.025, respectively. At these prices, the value of these fuels would be as follows:

shell	12 B	pieces x ₱0.05	= ₱0.6 B
husk	12 B	pieces x ₱0.025	= ₱0.3 B
palapa	400 M	pieces x 16 x ₱0.10	= ₱0.64 B
	Total		₱1.54 B

Calculated worth per barrel equivalent:

shell	₱0.6 B/6.36 M	= ₱94.33/bbl	= $4.72/bbl
husk	₱0.3 B/5.81 M	= ₱51.63/bbl	= $2.58/bbl
palapa	₱0.64 B/6.4 M	= ₱100/bbl	= $5.00/bbl

Energy calculations for one hectare of coconut palm. At present the average hectare of coconut contains 135 palms and yield about 40 nuts/palm-year. The annual harvest would then be 135 x 40 = 5,400 nuts and 135 x 16 = 2,160 pieces of palapa. Using the same values of weight per palapa, shell, etc. calculations may be made of the energy that can be provided by a hectare of coconuts. A summary is given in the following table:

	Kg	MJ	bbl	KWH
shell	1,042	23,970	2.86	6,658
husk	1,307	21,875	2.61	6,076
palapa	1,080	18,079	2.16	5,022
TOTAL	3,429	63,924	7.63	17,756

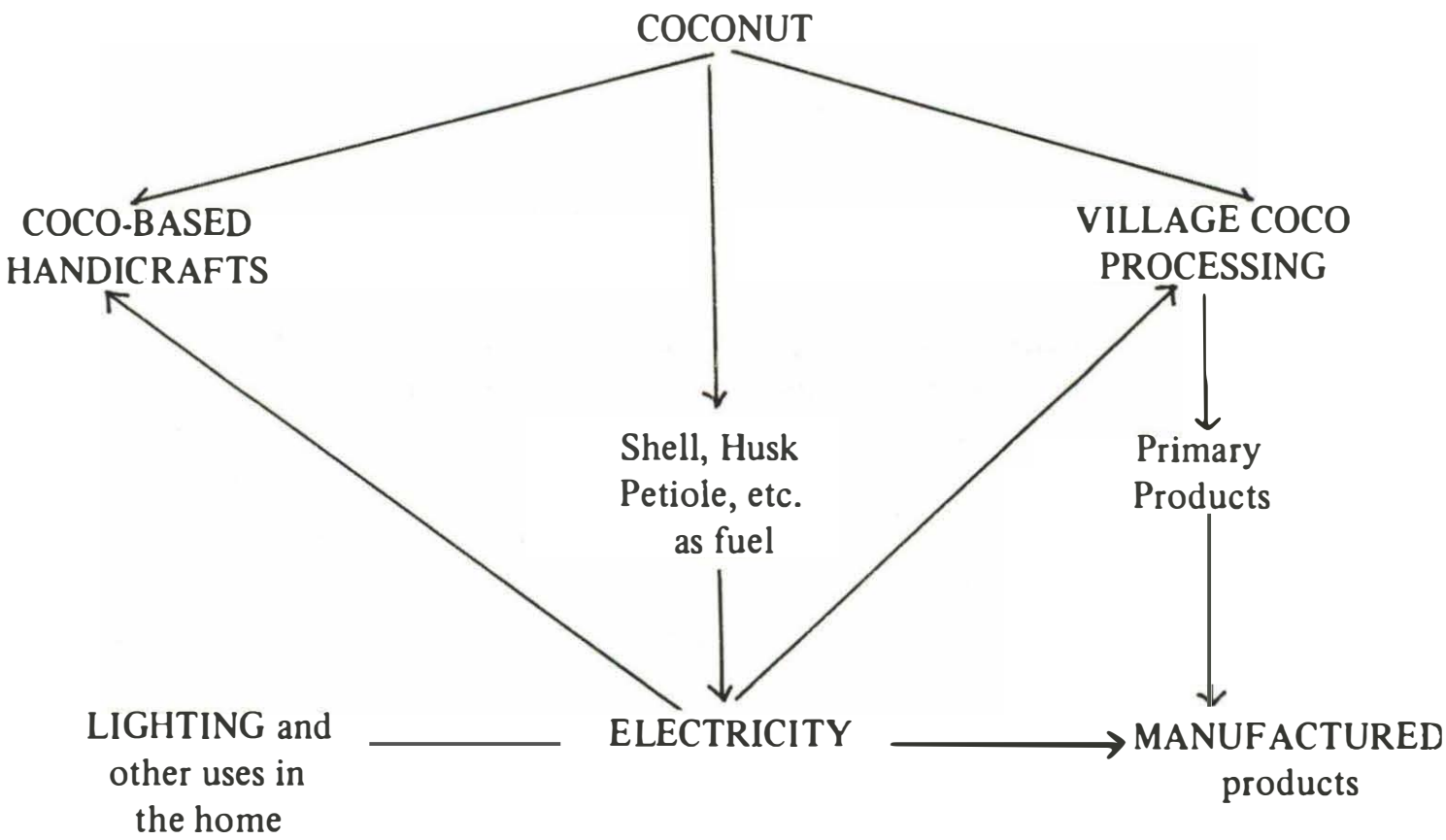
At 5% energy conversion to electricity, one hectare of coconut can yield 887.8 KWH per year or 74 KWH per month. A hectare of coconut can therefore provide the electrical needs of one village household.

Utilization of coconut-derived fuels. While there is an enormous quantity of coconut shell, husk and palapa which can be used as fuel, there is the problem of utilization. The most practical is probably electricity generation especially for villages that are outside the commercial lines. By placing the generators within the coconut groves, the problems of fuel transport may be minimized. Local labor can be used for gathering. Transmission lines among dwellings may use the coconut trees as posts.

Summary

Coconut shell, husk and petiole (palapa) which at present already contribute 5.9 percent of Philippine energy needs, may further be exploited. The energy potential is equal to 18.57 million barrels of petroleum oil equivalent or about 20 percent of national needs, at an average price of about $4/bbl. There are advantages in employing these coconut-derived fuels for local electricity generation.

The availability of electricity is probably most crucial in attempts of rural development. The present project on village coconut processing is hampered by lack of dependable supply of electricity. Coconut processing alone is not enough to bring relief to the farmers, it must be expanded to manufacturing and handicrafts using materials from the coconut palm. Summarized, these activities may be outlined in the following form:



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